STATUS OF CLAIMS

Claims 1-26 are pending.

Claim 26 is withdrawn from consideration.

Claims 1-25 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Tognazzini et al. (US Patent No. 5,886,683) in view of Jones (GB 2,170,910).

OVERVIEW OF CLAIMED INVENTION

The present invention provides for a system and method for recognizing, from eye gaze patterns, when the user is reading, skimming, or scanning on a display filled with heterogeneous content. Heterogeneous content includes objects normally encountered on computer monitors, such as text, images, hyperlinks, windows, icons, and menus. In one embodiment, the system uses information about what text the user is reading or skimming to infer user interest and uses this information to adapt to the user's needs. The adaptation process includes recording the text of interest in a user model and using the text to find related information from local machine databases, local area network databases, or wide area network databases such as the World Wide Web.

The present invention's method for recognizing, from eye-gaze patterns, when a user is reading, skimming, or scanning, comprises at least the steps of: (1) coarse or quantized representation of eye-movements of a user viewing heterogeneous content (e.g. text, images, hyperlinks, windows, icons, menus, etc.), (2) pooled evidence based detection, and (3) mode switching. First, the eye-movements in both x and y positions are quantized (and averaged) (e.g., over 100 ms intervals). This process removes some of the inaccuracy of prior art eye tracking hardware and reduces the influence of micro-saccades. Second, evidence of reading is

accumulated until it crosses a threshold value. The system may increment a reading evidence variable by 1, for instance, when the eye moves to the right and de-incrementing by 1, for instance, when the eye moves to the left. If the reading-evidence reaches a threshold, then "reading" is detected and the mode switched from scanning to reading. If the threshold is not reached, then the system continues to collect evidence of reading.

The U.S. patent to Tognazzini et al. (hereon Tognazzini), on the other hand, discloses an effort to capitalize on eye-gaze as a measure of user interest. Tognazzini describes a method and apparatus for providing relevant information based on eye-gaze. For example, interest in some display object (icon, image, or block of text) is determined based on a fixation threshold. If the user looks at an object on the screen long enough, the system infers that the user is interested in that object. This same rule also applies to blocks of text.

The Foreign patent (GB 2170910) to Jones (hereon Jones) provides for an eye tracking system with a control signal that is responsive to the 'direction of look' of a person's eye. Eye movement is detected by constantly measuring the rate of change of potential difference between the electrodes and comparing it against a threshold rate of 2° per second. It should be noted that the threshold value described in Jones describes a "threshold value for eye movement" (page 2, line 63) and not a threshold value of reading (as provided for in the present invention).

It should be pointed out that there is no disclosure, either explicitly or implicitly, provided for in Tognazzini and/or Jones to:

1. determine different levels of user interest based on the type of user behavior, such as reading (high interest), skimming (medium), or scanning (low interest),

2. switch modes from either a skimming or scanning mode to a reading mode when reading is detected, or
3. capture the exact words that are read by a user, wherein the captured words are utilized to:
    a. find relevant information in a database over a network (such as the Internet);
    b. develop accurate models of users;
    c. determine fine grained information regarding Internet advertising; or
    d. provide context based help in computer applications.

In the Claims

REJECTIONS UNDER 35 U.S.C. § 103(a)

The Examiner has rejected claims1 25 under U.S.C § 103(a) as being unpatentable over Tognazzini in view of Jones. With respect to these claims (claims 1-25), applicants respectfully disagree with the Examiner as they contend that the presently claimed invention cannot be obvious in view of any of the references because, even if there were a suggestion to combine them, a combination of these references would not result in the presently claimed invention

With respect to claim 1, the Examiner states that the Tognazzini discloses a method of (1) recognizing reading, skimming, and scanning modes from eye gaze patterns (in col. 4, lines 50-54 and col. 17, lines 1-5) and (2) quantizing eye movements. A close reading of Tognazzini references, however, indicates that the disclosed method determines whether the user skimmed the information or read the information by "measuring the amount of time spent with each article and advertisement" (see column 17, lines 1-5 of the Tognazzini reference) Thus, Tognazzini detects regions of interest (not actual reading) by determining the time spent gazing at a

particular region of the computer screen. By stark contrast, reading is detected based upon "accumulating a numerical evidence of reading until a predetermined threshold is reached" (see claim 1 of the claimed invention). Applicants contend that the present invention's reading detection is different and much more sophisticated than Tognazzini's method in the fact that the claimed invention's method of detecting reading is based upon collecting a numerical evidence and threshold.

One specific example of the claimed invention (as outlined in page 9, line 10 to page 10, line 1 of the application as filed) provides for a reading-evidence variable that can be incremented by 1 when the eye moves to the right and decremented by -1 when the eye moves towards the left. The reading evidence is then compared against a predetermined threshold (say 3) before reading is detected. This is in stark contrast with the method of Tognazzini wherein a region of interest is detected (not actual reading) based upon the amount of time spent gazing at that particular region in a computer screen.

Applicants agree with the Examiner's statement that Tognazzini fails to mention the limitation of "accumulating a numerical evidence of reading until a predetermined threshold is reached; and detecting reading when the numerical evidence of reading exceeds the threshold." Applicants, however, strongly disagree that the Jones reference provides for these features. A close reading of the Jones reference clearly suggests that signal rate of change is compared against a threshold value of eye movement measured in degrees/sec (see page 2, lines 48-52 and lines 61-65 of the Jones reference) and not against a numerical threshold value of reading (as required by claim 1).

Applicants thus contend that the combination of Tognazzini and Jones does not make the claimed invention obvious. The above-mentioned arguments equally apply to independent claims 12, 23, 24, and 25. Thus, applicants respectfully ask the examiner to reconsider independent claims 1, 12, 23, 24, and 25 in light of the above mentioned arguments.

Regarding dependent claim 2, applicants contend that Tognazzini does not teach, either by itself or in combination with Jones, a method for quantizing eye movements for detecting reading via a threshold. As to dependent claim 3, applicants contend that Tognazzini fails to provide for a method for detecting reading (via a threshold) when a user is reading, skimming, or scanning heterogeneous content. Regarding dependent claims 4 5 Tognazzini fails to provide for a threshold-based reading detection method that includes a step for switching between a scanning/skimming mode to a reading mode (when reading is detected upon reaching the threshold). Additionally, as mentioned above, the Jones reference clearly suggests that signal rate of change is compared against a threshold value of eye movement and not against a numerical threshold value of reading.

With regard to dependent claims 6 and 10-11, applicants contend that Tognazzini provides for a method for monitoring eye gaze patterns to determine a level of interest. Thus, the method of Tognazzini measures the time period and location (within the screen) of an eye gaze Thus, if a user stares at a particular area of a computer screen (see column 10, lines 5 10 of Tognazzini), the method of Tognazzini identifies the article corresponding to that particular area and articles related to the identified articles are provided to the user. By sharp contrast, the present invention's method detects reading (as opposed to gazing or staring) via a threshold and in the instance that reading is detected, the present invention extracts the text (see "recording said

heterogeneous content" aspect of claim 1) that was read and retrieves additional information (retrieved from a database over a network).

Regarding independent claim 7 and 8, applicants contend that method of Tognazzini fails to provide for an accurate model of users as provided by the claimed invention. The method of Tognazzini identifies what applications on a computer screen (or areas on a computer screen) are getting the user's attention and any such identified applications or areas are then used to fine tune additional information (e.g., advertisements) provided. On the other hand, the present invention's method first detects what information was read by a user (based upon a threshold), and upon detection of reading, the present invention's method extracts the read text and fine tunes accurate models and advertisements based upon the read text that was extracted.

As to claim 9, applicants refer the Examiner to section D of page 12 of the application as filed. This specifically outlines the use of the method of the present invention to provide for accurate help in computer applications. For example, by analyzing read text, a system can provide accurate help based upon the read text (see context-sensitive help of section D of page 12 of the application as filed). Tognazzini fails to disclose the accurate help feature of the present invention.

The above-mentioned arguments for dependent claims 2-11 equally apply to dependent claims sets 14-22. Thus, applicants respectfully ask the examiner to reconsider dependent claims 2-11 and 14-22 in light of the above mentioned arguments.

SUMMARY:

As has been detailed above, none of the references, cited or applied, provide for the specific claimed details of applicants' presently claimed invention, nor renders them obvious. It is believed that this case is in condition for allowance and reconsideration thereof and early issuance is respectfully requested.

As this amendment has been timely filed within the set period of response, no petition for extension of time or associated fee is required. However, the Commissioner is hereby authorized to charge any deficiencies in the fees provided to Deposit Account No. 09-0441.

If it is felt that an interview would expedite prosecution of this application, please do not hesitate to contact applicants' representative at the below number.

Respectfully submitted,

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APPENDIX A

In the Specification:

Please amend page 2, line 20 to page 3, line 1 as follows:

quantization - integration (usually averaging) of a sequential group of measurements where the measurements in each group do not overlap. The measurements may be over time or space. In the ~~case~~ they ~~are over~~ time.

Please amend page 3, lines 7 to 22 as follows:

Computers are a widely used resource in today's society. In most systems, a user manipulates a keyboard or a mouse to communicate with a computer. Modern systems include a graphical user interface (GUI) which communicates with the user by displaying various heterogenous content. In the context of this patent application, heterogeneous content includes objects normally encountered on computer monitors. For example, as illustrated in Figure 1, heterogeneous content **100** includes (but is not restricted to) any of, or a combination of: text **102**, images **104**, hyperlinks **106**, windows **108**, icons **110**, or menus **112**. When users view a computer monitor with heterogeneous content displayed on its screen, they utilize an input device, such as a mouse or a keyboard, to manipulate one (or a combination of) heterogenous content items based on their interests. Figure 2 illustrates a prior art system which comprises monitor **200**, computer CPU unit **202**, mouse **204**, and keyboard **206**. Users view on the computer monitor **200** various heterogeneous content items (like **A**, **B**, and **C**) and, based on their interest, they interact with one or more or a combination of heterogeneous content items via mouse **204** or keyboard **206**. This step is very "user driven" since the system does not have a means for dynamically tracking user interests (whether they are interested in **A**, **B**, or **C**) regarding the displayed heterogenous content and hence the computer waits for the user to respond via an input device before proceeding with any action.

Please amend page 4, lines 13 to page 5, line 7 as follows:

Figure 3 illustrates some of the common eye movements observed during reading. Common eye movement behaviors observed in reading **300** include forward saccades (or jumps) **302** of various length (eye-movements to the right), micro-saccades (small movements in various directions) **304**, fixations of various duration **306**, regressions (eye-movements to the left) **308**, jitters (shaky movements) **310**, and nystagmus (a rapid, involuntary, oscillatory motion of the eyeball) **312**. As illustrated by Figure 4, these behaviors in turn depend on several factors **400**, some of which include (but are not restricted to): text difficulty **402**, word length **404**, word frequency **406**, font size **408**, font color **410**, distortion **412**, user distance to display **414**, and individual differences **416**. Individual differences that affect eye-movements further include, but are not limited to, reading speed **418**, intelligence **420**, age **422**, and language skills **424**. For example, as the text becomes more difficult to comprehend, fixation duration increases (as described by Just & Carpenter in their paper entitled, *A theory of reading: From eye fixations to comprehension* ,Psychological Review, 1980) and the number of regressions increases (as

described by Rayner & Frazier in their paper entitled, *Parsing temporarily ambiguous complements.* Quarterly Journal of Experimental Psychology, 1987.) Given the complexity of eye-gaze patterns and the detailed information about the text and the individual required to predict these patterns, there have been no attempts to build a system to recognize reading until now.